

WHAT IS CLAIMED IS:

1. A method of qualitatively evaluating a digital audio signal, wherein it calculates, in real time, in continuous time, and in successive time windows, a quality indicator which is obtained only from said digital audio signal and consists of a vector associated with each time window.
2. A method according to claim 1, wherein said vector has a dimension at least one hundred times less than the number of audio samples in a time window, said dimension being from 1 to 10, for example, preferably from 1 to 5, and more particularly from 2 to 5.
3. A method according to claim 1 or claim 2, wherein the generation of a quality indicator vector employs the following steps for a reference audio signal and for the audio signal to be evaluated:
 - a) calculating for each time window the spectral power density of the audio signal and applying to it a filter representative of the attenuation of the inner and middle ear to obtain a filtered spectral density,
 - b) calculating individual excitations from the filtered spectral density using the frequency spreading function of the basilar scale,
 - c) determining the compressed loudness from said individual excitations using a function modeling the non-linear frequency sensitivity of the ear, to obtain basilar components,
 - d) separating the basilar components into classes, preferably into three classes, and calculating for each class a number C representing the sum of the frequencies of that class, said vector consisting of said numbers C, and
 - e) calculating a distance between the vectors of the reference audio signal and the audio signal to be evaluated associated with each time window to evaluate

the deterioration of the audio signal.

4. A method according to claim 1 or claim 2, wherein the generation of a quality indicator vector for the reference audio signal and for the audio signal to be evaluated employs the following steps:

a) calculating N coefficients of a prediction filter by autoregressive modeling,

b) determining in each time window the maximum of the prediction residue as a difference between the signal predicted with the aid of the prediction filter and the audio signal, said maximum of the prediction residue constituting said quality indicator vector, and

c) calculating a distance between said vectors of the reference audio signal and the audio signal to be evaluated associated with each time window to evaluate the deterioration of the audio signal.

5. A method according to claim 1, wherein the generation of a quality indicator vector employs the following steps for the reference audio signal and for the audio signal to be evaluated:

a) calculating for each time window the spectral power density of the audio signal and applying to it a filter representative of the attenuation of the inner and middle ear to obtain a frequency spreading function in the basilar scale,

b) calculating individual excitations from the frequency spreading function in the basilar scale,

c) obtaining the compressed loudness from said individual excitations using a function modeling the non-linear frequency sensitivity of the ear, to obtain basilar components,

d) calculating N' prediction coefficients of a prediction filter from said basilar components by autoregressive modeling, and

e) generating for each time window a quality

indicator vector from only some of the N' prediction coefficients.

5 6. A method according to claim 5, wherein the quality indicator vector comprises from 5 to 10 of said prediction coefficients.

10 7. A method according to claim 1, wherein the generation of a quality indicator vector employs the following steps for at least the audio signal to be evaluated:

a) calculating a temporal activity of the signal in each time window,

b) calculating a sliding average over N_1 successive values of the temporal activity, and

15 c) retaining the minimum value of M_1 successive values of the sliding average.

20 8. A method according to claim 7, wherein said quality indicator vector consists of said minimum value.

9. A method according to claim 7, wherein said quality indicator vector consists of a binary value that is the result of comparing said minimum value with a given threshold.

25 10. A method according to any one of claims 7 to 9, wherein it calculates a quality score by determining a cumulative time interval during which said minimum value is below a given threshold S_1 and/or by determining the number of times per second said minimum value is below a given threshold S'_1 .

35 11. A method according to any one of claims 7 to 10, wherein said minimum values are generated at the same time for the reference audio signal and for the audio signal to be evaluated and a quality vector is generated by comparing the corresponding minimum values for the

reference audio signal and for the audio signal to be evaluated.

12. A method according to claim 1, wherein the generation
5 of a quality indicator vector employs the following steps
for at least the audio signal to be evaluated:

f) calculating a temporal activity of the signal in
each time window,

g) calculating a sliding average over N_2 successive
10 values of the temporal activity, and

h) retaining the maximum value from M_2 successive
values of the sliding average.

13. A method according to claim 12, wherein said quality
15 indicator vector consists of said maximum value.

14. A method according to claim 12, wherein said quality
indicator vector consists of a binary value resulting
from comparing said maximum value with a given threshold
20 S_2 .

15. A method according to claim 12, wherein a
deterioration indicator vector is generated by comparing
the maximum value obtained for the reference audio signal
25 and the corresponding maximum value obtained for the
audio signal to be evaluated.

16. A method according to claim 1, wherein the generation
of a quality indicator vector calculates, at least for
30 the audio signal to be evaluated, the Fourier transform
in successive blocks of N_3 samples constituting said time
windows and the minimum value of the spectrum in M_3
successive blocks, said minimum value of the spectrum
constituting a quality indicator vector.

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17. A method according to claim 16, wherein it includes a
step of evaluating the introduction of noise into the

audio signal to be evaluated by comparing the value of said minimum value of the spectrum in M_3 successive blocks associated with the audio signal transmitted and the maximum value of the M_3 minima obtained in the same M_3 successive blocks associated with the reference audio signal.

18. A method according to claim 16, wherein it includes a step of evaluating the introduction of noise into the audio signal to be evaluated by comparing the value of said minimum of the spectrum in M_3 successive blocks with an average value of the minima of the spectrum obtained in blocks anterior to said M_3 successive blocks.

19. A method according to claim 1, wherein it calculates, at least for the audio signal to be evaluated, a quality indicator vector consisting of a spectrum flattening parameter that is the ratio between an arithmetical mean and a geometrical mean of the components of the spectrum of the signal.

20. A method according to claim 19, wherein it uses an indicator of detection of deterioration of the audio signal by the introduction of wideband noise by comparing said spectrum flattening parameter between the reference audio signal and the audio signal to be evaluated.

21. A method according to any preceding claim, wherein the audio signal to be evaluated is an audio signal transmitted digitally.

22. A method according to any preceding claim, wherein the audio signal to be evaluated is a digital audio signal to which digital coding has been applied.

23. A method according to claim 22, wherein said digital coding is bit rate reduction coding.